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A REEVALUATION OF *PRISTINA LONGISETA* (OLIGOCHAETA: NAIDIDAE) IN NORTH AMERICA

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Pristina longiseta Ehrenberg, 1828, long has been recognized as one of the most common aquatic oligochaetes in the world. Through the years, it has been determined to be cosmopolitan and has had several subspecies erected, usually coinciding with a continental distribution. The longest stable alliance of subspecies is: *P. longiseta longiseta* in Europe, *P. l. sinensis* in China and Africa, *P. l. leidyi* in North America, and *P. l. bidentata* in South America.

Michaelsen (1905a:309) initiated the trinominal concept by recognizing as conspecific *P. longiseta* forma *typica* from Europe and Zanzibar and *P. longiseta* var. *Leidyi* from North America and Paraguay. It was Sperber (1948:236), however, who adapted the many names into the subspecies concept as required by the International Code of Zoological Nomenclature.

In working with the Naididae, we have been impressed with the number of reports of the species in all its forms, but especially with the scarcity of morphometric data maintaining the undoubted validity of the subspecies concept. Several recent authors have raised questions regarding the validity of the subspecies, but no overt action was taken. Sperber (1948:236) said ". . . the distribution of the different forms of the *longiseta* complex indicates that they are geographical races, or perhaps even species, forming together a 'Rassenkreis,' or an 'Artenkreis.' " Brinkhurst and Jamieson (1971:

404) said ". . . it is almost impossible to separate *leidyi* from the combination of . . ." *P. l. longiseta* and *P. l. sinensis*, two subspecies which they synonymized.

Working under the subspecies concept of Western Hemisphere forms, Harman (1966:241, 1973:160) and Harman and Platt (1961:93) reported *P. l. leidyi* from several localities in North America. This was done with the idea in mind that any *P. longiseta* form in North America was automatically *leidyi*, and critical examination was foregone in the interest of expediency.

Because of modest numbers of Central American specimens at hand and because the exact point of demarcation between the ranges of *bidentata* and *leidyi* was not known, every specimen from Central America received critical examination. They all were *P. l. bidentata*. When *bidentata* also was determined to be the subspecies present in the Rio Grande region of Mexico, further interest in Texas specimens was stimulated. These also were determined to be *bidentata*. Because both *bidentata* and *leidyi* then were known to be sympatric, the prevailing concept of subspecies in the Western Hemisphere was under greater doubt. We set out to reexamine all specimens in our collection to determine where the form *leidyi*, characterized by simple-pointed needles, was to be found and how far northward the *bidentata* form, characterized by bifid needles, extended. To our great surprise and chagrin, no specimen taken in North America could be identified as *leidyi*. Critical examination of the needle setae revealed that every specimen had, in fact, a bifid needle. Therefore, the simple-pointed needle of *leidyi*, now regarded as the cardinal separatory character between *bidentata* of South America and *leidyi* of North America, did not exist. In defense of nearly a century of error, it can be stated that the bifid condition of the needle is an extremely difficult characteristic to see and that exact profile under the highest magnification using phase contrast microscopy usually is required. Even then, one is not able to see this characteristic in every setal bundle because of debris, broken setae, or the position of the mount. We now have critically re-examined every specimen available to us (nearly 600) representing more than

150 collections from 15 states in the United States and from Mexico. There is not a single specimen which does not have at least one setal bundle showing the bifid condition of the needle.

Pristina longiseta was described by Ehrenberg (1828:112), who characterized it as having an anterior proboscis, 7–8 uncinate setae ventrally, and three setae per bundle dorsally, longest in III. Undoubtedly, this was an adequate description at the time to separate this species from all others. Leidy (1850:44) reported a North American form which he placed in Ehrenberg's species because it corresponded to it ". . . as far as the description goes." To Ehrenberg's description, Leidy added that each worm possessed 16 segments, the ventral setae were retractile, and the dorsal setae of III were twice the length of the others.

Vejdovský (1884:31), providing the most complete description of *Pristina longiseta* among the early authors, stated that the dorsal setae all were capilliform, not noting the existence of needles.

Smith (1896:396) described *Pristina leidyi* from Illinois, stating that it probably was identical to Leidy's form of *P. longiseta*. He expressed appreciation to Vejdovský, whose familiarity with *P. longiseta* caused them to concur that the North American form was distinct from, but closely allied to, the European species. Smith, too, noted only hair setae in the dorsal bundles, but he did state that one hair in each bundle often was quite short, undoubtedly referring to the needle. Also, for the first time, serrations were seen on the hair setae. Smith saw no serrations on the proximal half of a fully-formed seta. In the middle of the hair, serrations were 6 μm apart, and the serrated condition was most evident distally.

Michaelsen (1905b:357) noted serrations on hairs of specimens from Germany and Paraguay, which he therefore identified as *P. leidyi*. Moore (1906:166) noted the absence of serrations on the hair setae of both II and III in *P. leidyi* although he did not detect the presence of needle setae. Piguet (1906:292) was the first author to observe that hair setae, with the exception of those in III, were serrated in *P.*

longiseta, and he was the first to note the presence of needles in the dorsal bundles of this species. The needles, 2–5 per bundle, were straight, tapering to a thin single point, and without a nodulus. Hayden (1914:137), describing a species which later was synonymized with *P. leidyi*, also observed the presence of serrated hairs, except in III, and needles in the dorsal bundles.

Michaelsen (1905a:309) placed the North American and South American forms as a variety of *P. longiseta*, i.e. *P. l.* var. *Leidyi*, and other forms were designated as *P. longiseta* f. *typica*. Chen (1940:47) compared the two forms and restored them to species rank on the basis of differences in hair serrations and the ventrals of II and III.

Černosvitov (1942:198), apparently unaware of Chen's work, described a variety of *P. longiseta* from Argentina which he named *P. longiseta*, var. *bidentata* in reference to the bifid condition of the needles. In addition to the needles, this form differed from f. *typica* in having closer serrations on the hairs and a greater difference between the teeth of ventrals of II.

Marcus (1943:107), probably not cognizant of the simultaneous work of Černosvitov, described *P. longiseta* f. *typica* from Brazil as possessing needles which were finely bifid.

Sperber (1948:236) stated that *P. longiseta* in its various forms might consist of a number of geographical races or even species, recommending that additional work must be done to clarify the status of the group. She recognized four races of the Rassenkreis *Pristina longiseta* although giving them subspecific status: *P. l. longiseta*, *P. l. sinensis*, *P. l. leidyi*, and *P. l. bidentata*.

Brinkhurst and Jamieson (1971:403) reduced the list to three subspecies by the synonymy of *P. l. sinensis* with *P. l. longiseta*. They observed that there was difficulty in separating *leidyi* from the new combination, indicating that further synonymy might be required.

We now are abolishing the subspecies concept and reporting *Pristina leidyi* Smith, 1896, to be the species name for all the forms reported from North America, South America, and Hawaii. The name is chosen because of priority held by Smith's name over that established by Černosvitov (1942:

198). This is regrettable due to the fact that the description must now include bifid needles for the species, the characteristic upon which Černosvitov's name *bidentata* was based. It here is deemed prudent to return to specific status (without subspecies) Ehrenberg's *P. longiseta* as the name for all those forms reported from Europe, Asia, and Africa. A form reported by Jackson (1931:74) from Australia cannot be identified with certainty, but it may fit better with *P. longiseta.*

It is apparent that descriptions currently found in the literature for subspecies of *Pristina longiseta* are composites of data published over a span of nearly 150 years. It is evident that, far too frequently, published data were assumed to represent fact without further investigation. The example at hand is the prevalent assumption that *P. l. leidyi* is distinguished from *P. l. bidentata* primarily by the existence of simple-pointed needles in *leidyi*, in contrast to the bifid needles of *bidentata.* Therefore, the following description of *Pristina leidyi* is based solely on our collection of this species to prevent the preservation of any erroneous information which might have been published in the past.

Pristina leidyi Smith, 1896, new combination

Prostomium forming a proboscis. Hair setae, 1–4 per bundle, beginning in II, serrated, except in II and III, the latter extremely elongated. Serrations up to 10 μm apart on mid-shaft, becoming closer distally. Needles, 1–4 per bundle, beginning in II, fine and straight, finely bifid, without nodulus. Ventral setae, 2–10 per bundle anteriorly, 2–12 posteriorly; in II much longer and thicker than the rest, with distal tooth twice as long as the proximal; in III, slightly longer and thicker than the rest, with distal tooth 1½ to 2 times as long as proximal; in the rest, teeth approximately equal; nodulus in II slightly proximal to median, median in III, becoming slightly distal posteriorly. Clitellum in ½VII–½X. Genital setae in VI, 1–3 per bundle, bifid, with long converging teeth, enclosed within glands. Stomach in VIII. n = 12–25. s = 13–41.

Distribution: North America, South America, Hawaii.

Discussion: From our material and from synonymy, *Pristina leidyi* is seen to be a species with considerable variability across its distribution; however, such variability is within reason for the species. The ranges of setal characteristics for all specimens from nine geographical regions within the distribution of *P. leidyi* are found in Table 1. Differences are seen in setal numbers and lengths between different

TABLE 1. Ranges of setal characteristics of *Pristina leidyi* from nine geographical areas within its distribution

Locality	Hair Setae: No. per bundle (most common)	Hair Setae: Length (μm) in III	Hair Setae: Length (μm) exclusive of III	Hair Setae: Serrations (μm)	Needle Setae: No. per bundle (most common)	Needle Setae: Length (μm)
Surinam (Harman, 1974)	1–4 (1–2)	375–750	142–294	5–1	1–3	20–75
Mexico	1–3 (1–2)	414–450	133–358	5–2	1–3 (2–3)	35–74
Texas–Oklahoma	1–3 (2–3)	502–768	130–420	3–2	1–3 (2–3)	25–88
Louisiana–Mississippi	1–4 (2–3)	228–740	127–491	5–1	1–4 (2–3)	30–93
Florida–Georgia	1–3 (2–3)	308–992	151–574	9–2	1–4 (2–3)	30–83
Tennessee–Kentucky	1–4 (2–3)	642–829	163–530	10–3	1–4 (2–3)	35–71
Michigan–Minnesota	1–3 (2–3)	604–811	136–465	6–3	1–4 (2–3)	28–64
Pennsylvania–Maryland	1–3 (2–3)	403–681	148–450	8–1	1–4 (2–3)	33–85
Hawaii	1–3 (2–3)	616–817	136–343	3–2	1–3 (2–3)	29–83

Locality	Ventral Setae: No. per bundle in II	Ventral Setae: Length (μm) in II	Ventral Setae: No. per bundle in III	Ventral Setae: Length (μm) in III	Ventral Setae: No. per bundle Posterior to III	Ventral Setae: Length (μm) Posterior to III
Surinam (Harman, 1974)	3–5	75–114	3–5	63–90	3–8	52–71
Mexico	4	78–86	4–5	66–77	2–8	53–70
Texas–Oklahoma	4–6	68–87	4–6	56–78	4–9	50–80
Louisiana–Mississippi	2–8	73–98	3–7	55–82	3–10	42–68
Florida–Georgia	3–10	67–98	4–9	55–83	4–12	48–76
Tennessee–Kentucky	5–8	72–83	5–6	63–72	4–9	53–68
Michigan–Minnesota	5–7	68–74	4–6	59–68	4–8	47–71
Pennsylvania–Maryland	4–7	68–96	4–7	57–80	4–11	48–66
Hawaii	4–5	70–84	4–7	52–62	4–12	48–60

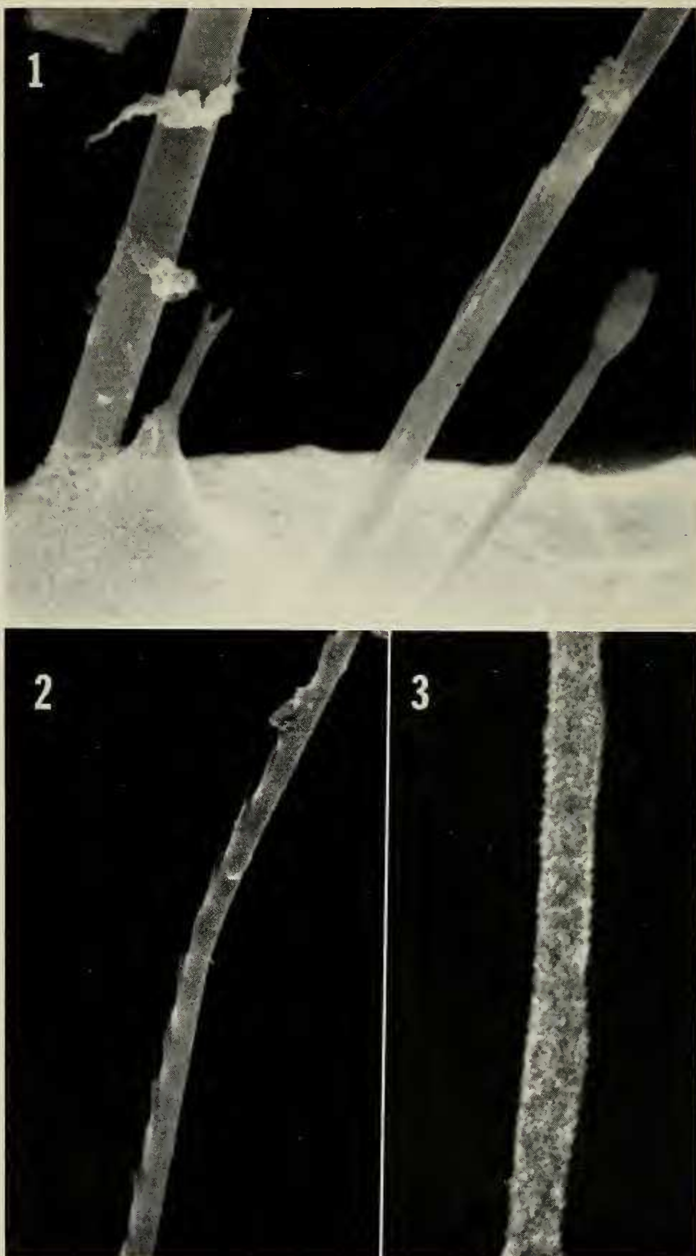
geographical areas, but such differences are slight. For instance, specimens from Mexico and Surinam characteristically usually have 1–2 hairs per bundle dorsally (in parentheses in Table 1), whereas worms from all other areas most often possess 2–3 hairs per bundle. This is a relatively minor difference, but it is one which occurs with regularity.

Characteristic of *P. longiseta* and *P. leidyi* is the presence of elongate, thickened hairs in III. In material examined in this study, the hairs of III were elongate, measuring 375–992 μm, and thickened in most cases. Occasionally, these hairs were shorter than those of other segments, especially those of mid-body, which characteristically are longest excluding those of III. Such comparatively short hairs in segment III were determined to be ones which had not developed completely and therefore had not reached their full length. The longest hair of segment III of each worm which was examined is included in the range given in Table 1; therefore, this range overlaps that of hair lengths from all other segments (127–574 μm).

Previous reports which made careful study of the hairs noted serrations (Fig. 2) on the hairs of all segments except III. This condition was first noted in *P. longiseta* (by synonymy) by Michaelsen (1905b: 357) and in *P. leidyi* by Galloway (1911:302). We must concur with Moore (1906:166), who noted the absence of serrations on the hair setae of segments II and III. After examining hundreds of specimens from throughout the Western Hemisphere, we have yet to see a serrated hair on II or III. The hairs of II often are short (125–200 μm) and covered in varying degrees with debris which might be construed to be serrations; however, critical examination at 1000 × (phase contrast) reveals that these hairs indeed are smooth, i.e. non-serrated. Scanning electron micrographs up to a magnification of 1000 × also fail to show serrations on hairs of II or III.

The teeth of the serrations in *P. leidyi* were stated by Smith (1896: 397) to be 6 μm apart in mid-seta, more evident distally, and absent proximally. Later authors extended the inter-dental distance in mid-seta to 8–16 μm in *P. leidyi* (Chen, 1940:47). Černosvitov (1942: 199) found this distance to be 3.75 μm in *P. l. bidentata*. With our synonymy of these two forms, the literature records a mid-setal inter-dental range of 3.75–16 μm, which compares favorably with our range of 3–10 μm (Table 1). An interesting and quite evident feature is that, of our material, the inter-dental distance in mid-seta is shortest, 3 μm, in specimens from Texas–Oklahoma and Hawaii (Table 1), whereas the longest such distances occur in material from areas most distant from the Texas–Oklahoma area (Tennessee–Kentucky, Florida–Georgia, and Pennsylvania–Maryland). In all cases, the serrations become more closely spaced towards the distal tip of the hair, approaching 1 μm, this being indicated by the latter figure given in the hair serrations column of the table.

It is unknown by what method earlier authors measured the distances between serrations, i.e. between what two points they measured.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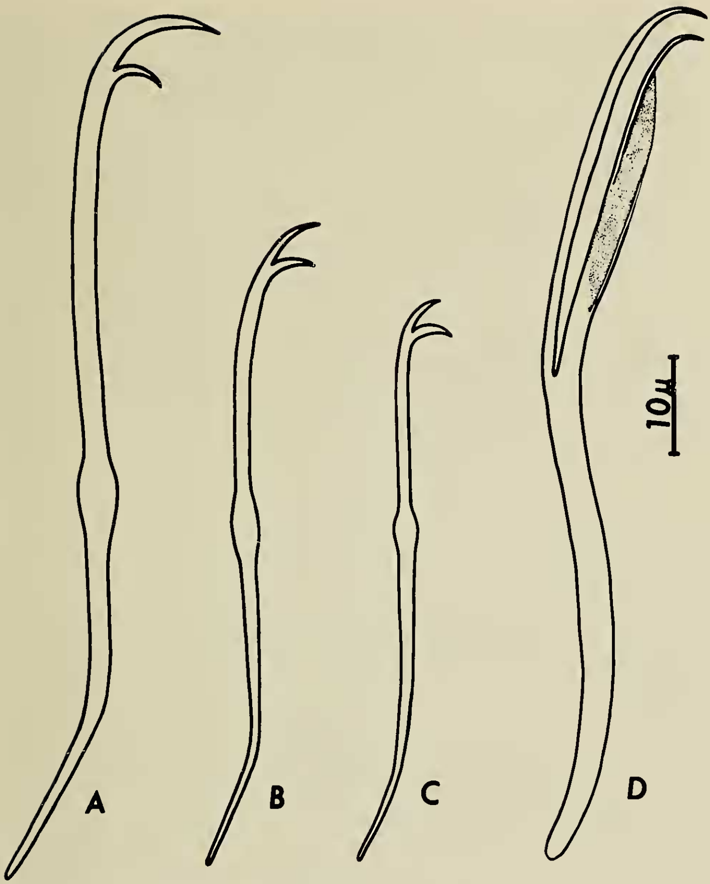

FIG. 4. Ventral setae of *Pristina leidyi*. A, ventral seta of II; B, ventral seta of III; C, posterior ventral seta; D, genital seta.

In determining these distances in our material, we determined the distance between similar portions of two adjacent serrations (tips of teeth, center of portions of serration that contact hair shaft, etc.). It is possible that some earlier authors used similar techniques, whereas others

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FIGS. 1–3. Scanning electron micrographs of *Pristina leidyi*. 1, dorsal setal bundle with two needles and two hairs, × 5000; 2, hair seta near tip, × 5000; 3, hair seta of II, showing minute serrations, × 20,000.

may have measured the actual distance *between* the serrations, therefore obtaining smaller measurements.

Scanning electron microscopy at high magnifications reveals that, indeed, all hairs bear serrations. At a magnification of 20,000 diameters, serrations which are a mere 0.08 μm apart are very evident (Fig. 3). It is believed that such structures, previously undetected, represent a spiral surface modification. Because of this discovery, the statement that "hairs of II and III are unserrated" must be qualified by adding "as observed at 1000 × with phase contrast microscopy."

Černosvitov (1942:199), in his description of *P. l.*, var *bidentata*, stated that the 1–3 needles per bundle were fine, without a nodulus, and gradually tapered to the tip, which was bifid. This characteristic in itself was sufficient to distinguish his variety from any other form or variety of *P. longiseta.* The teeth were stated to be less than 0.75 μm in length, approximately equal, and spread at an obtuse angle. Marcus (1943:108) recorded a length of up to 100 μm for needles. In our material, each dorsal bundle contains 1–4 (usually 2–3) needles which measure 20–93 μm, the shorter lengths coming from segments near the ends of the worms. The teeth are approximately equal and less than 0.75 μm in our material (Fig. 1) although they may not always be apparent. More often than not the bifurcation is obscured by debris (Fig. 1) or by the position/orientation of the needle being such that the tip of the needle is seen on edge rather than in profile. In the latter case, the needle may appear to be single-pointed or to have an expanded tip. Although the teeth often are less than 0.50 μm in length, the bifurcation is evident when it is seen in good profile at magnifications as low as 400 × (phase contrast). The geometric knowledge of Černosvitov is to be suspected concerning his description of the needle bifurcation as being obtuse. In actuality, the teeth of the needles form an acute angle (Fig. 1).

Ventral setae are fewer, thicker, longer, and have longer teeth in segments II and III than in following segments. In our material, there are 2–10, usually 3–8, ventrals in the first two setigerous segments. In II, the ventrals measure 67–114 μm, and, in III, they range 52–90 μm. Posteriorly, the range is 42–80 μm, there being up to 12 setae per ventral bundle, usually 4–10. Ventrals of III (Fig. 4B) are thinner than those of II (Fig. 4A) although thicker than those of more posterior segments (Fig. 4C); however, all ventrals are of the same general shape. In II, the distal tooth is approximately two to three times the length of the proximal, lengths being 5–7 μm and 2.5–3 μm respectively. In III, the distal is about 1½ to two times the length of the proximal, and, posteriorly, the teeth become subequal, approximately 3 μm in length. Beginning in VIII, the distal tooth is distinctly thinner than the proximal (Fig. 4C). The nodulus, often weak, is slightly proximal to median in II, approximately median in III, becoming slightly distal posteriorly. All characteristics of the ventral setae, and especially those of number and length (Table 1), are remarkably consistent throughout the distribution of *P. leidyi.*

Of nearly 600 specimens examined in the course of this study, only two individuals are clitellate, having a clitellum in ½VII–½X. Two worms, only one of which is clitellate, bear genital setae in VI, 1–3 per bundle. These setae (Fig. 4D) are greatly thickened, and the range of lengths is 80–86 μm. They are bifid, and the teeth are long, nearly equal in length, and converging at the tip. The length of the teeth is one-third to half the length of the whole seta. The proximal tooth, most dense at its edges, appears to be webbed medially due to the comparative thinness of this area. A genital gland encloses each bundle of genital setae.

Twenty-six worms, representing 4.3% of those examined, were undergoing asexual reproduction at the time of collection. The number of setigers anterior to the zone of fission varied from 12 to 25, usually 12–18. No worm had more than one budding zone. One worm which possessed a budding zone also bore genital setae in VI although it was aclitellate. Containing forty setigers, its budding zone followed XX, and it had three genital setae per bundle.

The stomachal dilatation occurs in VIII although it appears to begin in VII because it pushes septum 7/8 forward to mid-VII. It is approximately three times the diameter of the esophagus and of the anterior intestine and is nearly spherical with greatly thickened walls. Intestinal dilatation begins in IX, the diameter of this organ being greater than that of any other part of the digestive tract.

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